hypertonic solution no development takes place. Other hypertonic solutions, provided they possess a similar osmotic action and are not poisonous (as is the case, for instance, with copper salts), may also be used. Better methods have since been devised, *e.g.* treatment first with a fatty acid, such as butyric, then with sea-water, next with the hypertonic solution and finally removal to sea-water. The fatty acid initiates membrane formation, the hypertonic solution the oxidation processes. Various substances, such as saponin, which have a lytic or solvent action upon the cortical layer of the egg and therefore lead to membrane formation, can also be substituted for fatty acid.

Another fact of considerable interest is that blood or tissue-extracts, or the dead or living sperm, of a *foreign* species will induce membrane formation in the unfertilised sea-urchin egg, while the extracts of the sea-urchin itself are inefficient to do so and the *living* sperm is alone effectual. This appears to be due to the fact that the foreign materials can diffuse into the egg, while its own materials are unable to, but must be carried by the *living* sperm. Various questions connected with heredity are discussed, and finally a chapter deals with the interesting question—can an embryo develop from a sperm? Apparently in yolk and white of egg, fowl sperm can undergo transformation into a nucleus, but we are not yet in a position to state that the sperm can undergo mitosis outside the egg. Altogether this book can be recommended as an authoritative statement on artificial parthenogenesis by one who has himself contributed so much to the subject.

(2) Comparatively simple as the structure of the blood seems at first sight to be, the more it is studied the more complex it becomes, and the literature dealing with this subject has now become truly enormous. In the present volume the author has attempted to summarise the researches that have been carried out on the structure, functions, and origin of the various elements of the blood, both normal and abnormal, which make their appearance in cases of disease. On the whole we think the author has accomplished his object, and has produced a reference book which will be very useful to those who are working at this subject. A bibliography, a glossary of hæmatological terms (which runs into more than thirty pages), and indexes to subjects and to authors, complete a work which must have entailed a considerable amount of labour.

R. T. H.

MATHEMATICAL TEXT-BOOKS.

(1) (*a*) *Plane and Solid Geometry.* By Prof. W. B. Ford and C. Ammerman. Edited by E. R. Hedrick. Pp. ix + 321 + xxxiii. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1913.) Price 5*s*. 6*d*. net.

(*b*) *Solid Geometry.* By Prof. W. B. Ford and C. Ammerman. Edited by E. R. Hedrick. Pp. ix + 215–321 + xlix. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1913.) Price 3*s*. 6*d*. net.

(2) *A School Course in Geometry.* By W. J. Dobbs. Pp. xxii + 427. (London: Longmans, Green and Co., 1913.) Price 3*s*. 6*d*.

(3) *Analytic Geometry and Principles of Algebra.* By Prof. A. Ziwet and L. A. Hopkins. Pp. viii + 369. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1913.) Price 7*s*. net.

(4) *Slide-Rule Notes.* By Colonel H. C. Dunlop and C. S. Jackson. Pp. 127. (London: Longmans, Green and Co., 1913.) Price 2*s*. 6*d*. net.

(5) *A First Numerical Trigonometry.* By W. G. Borchardt and the Rev. A. D. Perrott. Pp. xi + 159 + xvii + xvii. (London: G. Bell and Sons, Ltd., 1913.) Price 2*s*. 6*d*.

(6) *Elementary Graphic Statics.* By J. T. Wight. Pp. xii + 227. (London: Whittaker and Co., 1913.) Price 4*s*. net.

(7) *Models to Illustrate the Foundations of Mathematics.* By C. Elliott. Pp. viii + 116. (Edinburgh: Lindsay and Co., 1914.) Price 2*s*. 6*d*. net.

(8) *Exercises in Mathematics.* By D. B. Mair. Pp. xi + 469. (London: Macmillan and Co., Ltd., 1914.) Price 4*s*. 6*d*.

(9) *A School Statics.* By G. W. Brewster and C. J. L. Wagstaff. Pp. viii + 248. (Cambridge: Heffer and Sons, Ltd., 1913.) Price 3*s*. net.

(10) *Proceedings of the London Mathematical Society.* Second series. Vol. xii. Pp. lix + 488. (London: Francis Hodgson, 1913.)

(1) IN America, as in England, the teaching of geometry has altered recently both in method and scope; and these changes are indicated in the report of the committee of the National Education Association, the recommendations of which have been in the main adopted by the authors of this volume. The limitations of the subject-matter are similar to those with which English students are familiar, but there is a marked difference in the arrangement. The treatment of areas is postponed nearly to the end of the course, thus enabling angle and

tangent properties of the circle and theorems in proportion and similarity, to be taken at an early stage.

The course of solid geometry, which occupies about one-third of the volume, and can also be obtained separately, follows the usual lines. There are three sections: (1) lines and planes in space; (2) polyhedra, cylinders, cones; (3) the sphere, the latter being treated more fully than usual. The examples are less conventional and more interesting than those in the ordinary text-book.

(2) The author holds very strongly that pure geometry should not be separated from other branches of mathematics. In a single volume he has included quite a considerable amount of trigonometry, calculus, and analytical methods (solid geometry is reserved for a second volume); and he has attempted to show how all these subjects should be combined together, each assisting the development of the other. If proofs of geometrical properties can be simplified by the use either of trigonometry or analysis, he maintains that not only is it legitimate to do so, but that it is definitely wrong to ignore this opportunity. Mr. Dobbs's book should exercise a refreshing influence on educational methods.

(3) Into the ordinary analytical course a certain number of sections on pure algebra have been introduced on the ground that their utility can best be explained in this connection. This certainly justifies the inclusion of simultaneous equations, theory of equations, complex numbers, gradients, and determinants; the brief account, however, of permutations and combinations in connection with the latter seems somewhat irrelevant. The examples are of a numerical character, and advanced geometry of the conic is left aside. Special mention must be made of an interesting section on higher plane curves and empirical equations. The last four chapters cover the usual course of solid geometry so far as quadrics referred to principal axes.

(4) Mr. Jackson's name is in itself a sufficient guarantee that students will find all that they can possibly require in this account of the use of the slide-rule. After a brief introduction there are successive chapters on proportion, evolution and involution, the solution of quadratic and cubic equations, the trigonometric and logologarithmic scales, the plotting of curves and errors. The reader must of course have a slide-rule in his hand, but the clearness of the diagrams from which all superfluous markings have been omitted will make his task easy.

(5) This book is designed for the junior forms of secondary schools, in view of the fact that trigonometry is now given an early place in the curriculum. The examples are therefore of a simple character; radian measure is postponed to the last chapter, and identities and compound angles are excluded. We think that an unnecessary amount of space has been devoted to logarithms; all modern text-books on arithmetic and algebra contain chapters on this subject, and its repetition here is a survival from the times when only seven-figure tables were used. There is a first-rate set of test-papers at the end of the book.

(6) This is a book for the practical engineer, but it contains many problems that might usefully be set to the mathematical specialist. No previous knowledge of mechanics and only the elements of algebra are required. After a clear discussion of resolution and composition, the triangle of forces and Bow's notation, various problems of the crane are considered. The graphical theory of moments, bending moments, and shearing forces is then described, and applications are made to dead and rolling loads, symmetrical and unsymmetrical roof loadings, wind pressure, walls withstanding pressure, centre of gravity and moments of inertia. The author has succeeded in compressing into a comparatively small compass a great deal of valuable matter. There is, of course, naturally nothing that is original, but the contents are just what the ordinary engineering student most needs.

(7) The purpose of this tract is to advocate the introduction of some account of modern views upon the foundations of mathematics into elementary work. It is claimed that by a judicious use of models an insight can be gained fairly easily into the root ideas of mathematical philosophy, and that by a method which involves only an extension or rearrangement of the practical work now being done at school. The ideas here dealt with are correspondence, class, classification, multiplexes, etc. We cannot think this is suitable for the ordinary boy: however simple the illustrations may be, he will almost certainly fail to carry away with him anything he can himself regard—and that is in itself of very great importance—as real knowledge.

(8) Every teacher should possess this book; the exercises cover the course of arithmetic, algebra, geometry, and trigonometry taken by the non-specialist, and may be used either for revision or to supplement at a first reading the ordinary text-book. Some of the sections are headed by a note recommending their omission if not required for examination purposes. Apart from these, the questions are so chosen as to test the intelligence of the student, to illustrate the utility of the

subject, and exhibit its practical bearing. It is the best collection of mathematical examples we have yet met.

(9) Now that an experimental course of statics has obtained a firm foothold in the school curriculum, it is possible to introduce boys of no special mathematical talent to certain features of theoretical work. In addition to the elements of geometry and algebra, nothing more than a knowledge of the trigonometry of the right-angled triangle is needed for applications of all the fundamental ideas which make this subject educationally valuable.

The volume before us contains just what is needed for work of this character. It opens with the use of pulleys and the ideas of work, power, velocity-ratio, and efficiency. Then follow simple cases of moments and applications to the more important machines. In this way the student is led at once to see the practical utility of the work, and is able by experiment to clarify his conception of force, etc. No use is made of the parallelogram and triangle of forces until comparatively late in the course, and formal bookwork proofs are postponed to the end. The examples are chosen so as to illustrate the principles of mechanics rather than to test the student's analytical ability.

(10) We are glad of this opportunity of directing attention to the work that is being done by the London Mathematical Society. All those who are interested in any branch of higher mathematics, whether they hope or intend to do any research work or not, should apply for election. Only in this way is it possible for students to keep in touch with the trend of modern developments when their University days are over.

OUR BOOKSHELF.

British Rainfall, 1913. Compiled under the direction of H. R. Mill. By R. C. Mossman and C. Salter. Fifty-third annual volume. Pp. 92+384. (London: E. Stanford, Ltd., 1914.) Price 10*s*.

THIS valuable publication is well known to readers of NATURE, having been frequently referred to in its columns. The fundamental part of the work includes: (1) general tables of total rainfall, and (2) observers' remarks on the weather; these are of great interest, and refer mostly to exceptional phenomena. The discussion of the data deals *inter alia* with monthly and seasonal rainfall, heavy daily falls, and the relation of the annual rainfall to the average. A great rainstorm of September 17, which was most intense near Doncaster, is illustrated by a coloured plate; the area with more than an inch of rain in about fourteen hours comprised more than 1300 square miles. The rainfall of the year over the whole of the British Isles was almost exactly equal to the average of thirty-five years (1875–1909). The excess in Wales was 9 per cent. and in Ireland 7 per cent.; elsewhere there was, generally speaking, a deficiency. The volume includes three special articles: (1) an appreciative memoir of the late Sir John Murray, who represented Scotland on the Board of Trustees of the British Rainfall Organisation; (2) the dry summer of 1913—in July and August the rainfall deficiency was 60 per cent. over the United Kingdom as a whole; (3) frequency of heavy rains in short periods, 1868–1913. The useful work of the organisation is dependent upon voluntary contributions, but unfortunately it is not self-supporting; the director has to meet considerable deficiencies, consequently application for Government aid has become necessary.

Handbook of Photomicrography. By H. Lloyd Hind and W. Brough Randles. Pp. xii+292+44 plates. (London: George Routledge and Sons, Ltd., n.d.) Price 7*s*. 6*d*. net.

THIS book gives a useful and adequate account of the theory and practice of photomicrography. It is written from the point of view of the beginner and amateur, and full explanations are given of the principles governing the results aimed at and of the methods for obtaining these results. Photomicrography with the lowest and highest powers is dealt with, and wherever possible simple and home-made apparatus is described. In addition to photomicrography proper, the various photographic processes are explained and described, and methods of making lantern slides, colour photography, and the preparation and mounting of objects are included. The book is well produced and profusely illustrated both by figures in the text and with forty-four plates, several of which are coloured and reproduced from direct colour photographs. The plates illustrate very well the different results that can be obtained with different methods of illumination, various objectives and varying adjustments. We believe that Messrs. Hind and Randle's handbook will be found a very useful work on the subject of photomicrography.

The Microscopy of Drinking Water. By Prof. G. C. Whipple. Third edition, rewritten and enlarged. Pp xxi+409+xix coloured plates. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1914.) Price 17*s*. net.

WE are glad to welcome the third edition of this valuable book. Since the first edition was issued in 1880 an enormous amount of work has been devoted to the study of the microscopic organisms in water, and the increase in size of the present edition bears witness to this. The mystery of the comings and goings of various groups of algæ and protozoa in our lakes and reservoirs still, however, remains unsolved. From the practical side much progress has been made in the artificial means of controlling Plankton growths and the purification of waters containing them.

The first part of the book has been almost rewritten, and contains chapters on copper treatment for eradication of algæ, the soil-stripping of